

Ministry of Education and Science of Ukraine
Dnipro University of Technology

Department of Electrical Engineering



«APPROVED»

Head of Department

Tsyplenkov D.V. 

«30» August 2022

WORK PROGRAM OF THE ACADEMIC DISCIPLINE

«Electrical Materials»

Field of study	14 Electrical engineering
Specialty.....	141 Electrical energetics, electrical engineering and electromechanics
Academic level	first(bachelor)
Academic program	«Electrical energetics, electrical engineering and electromechanics»
Specialization.....	-
Status.....	normative
Total workload.....	3 credits ECTS (90 hours)
Type of summative assessment...	differentiated test
Period of study	2 semester (4 term)
Language of study.....	English

Lecturer: Assoc.Prof. Kolb A.A.

Prolonged: for 20 __ / 20__ academic year _____ (_____) " __ " __ 20__.
(Signature, name, date)

for 20 __ / 20__ academic year _____ (_____) " __ " __ 20__.
(Signature, name, date)

for 20 __ / 20__ academic year _____ (_____) " __ " __ 20__.
(Signature, name, date)

Dnipro
DNIPROTECH
2022

Work program of the academic discipline «Electrical materials» for bachelors of the educational and professional program «Electrical energetics, electrical engineering and electromechanics» of the specialty 141 Electrical energetics, electrical engineering and electromechanics / Dnipro University of Technology, Department of Electrical Engineering. – D.: DNIPROTECH, 2022 – 13 p.

Author:

– Kolb Andrii Antonovych – Associate Professor, Candidate of Technical Sciences, Associate Professor of the Departments of Electrical Engineering.

The work program regulates:

- the aim of the discipline;
- the disciplinary learning outcomes generated through the transformation of the intended learning outcomes of the degree program;
- basic disciplines;
- volume and distribution by forms of organization of the educational process and types of classes;
- discipline program (thematic plan by type of training);
- algorithm for assessing the level of achievement of disciplinary learning outcomes (scales, tools, procedures and assessment criteria);
- tools, equipment and software;
- recommended sources of information.

The work program is designed to implement a competency approach in planning an education process, delivery of the academic discipline, preparing students for control activities, controlling the implementation of educational activities, internal and external quality assurance in higher education, accreditation of degree programs within the specialty.

Approved by the decision of the Scientific and Methodological Commission of the specialty 141 Electrical energetics, electrical engineering and electromechanics (protocol №21/22-07 of 14.07.2022).

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1 AIM OF THE DISCIPLINE

In the educational and professional program «Electrical energetics, electrical engineering and electromechanics» of the specialty 141 Electrical energetics, electrical engineering and electromechanics the distribution of program learning outcomes (PLO) for the organizational forms of the educational process is done. In particular, the following learning outcomes are attributed to the discipline Б6 «Electrical materials»:

PLO07	To carry out the analysis of processes in the electric power, electrotechnical and electromechanical equipment, the corresponding complexes and systems
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The aim of the discipline – formation of competencies in the operation of electrical materials.

The implementation of the aim requires transforming program learning outcomes into the disciplinary ones as well as an adequate selection of the contents of the discipline according to this criterion.

2 INTENDED DISCIPLINARY LEARNING OUTCOMES

Code PLO	Disciplinary learning outcomes (DLO)	
	Code DLO	content
PLO07	PLO07.1-Б6	Analyze processes in electric power, electrotechnical and electromechanical equipment, relevant complexes and systems, taking into account the properties of dielectric, conductive and magnetic materials
	PLO07.2-Б6	Calculate the parameters of dielectric, conductive and magnetic materials used in the elements of electric power, electrotechnical and electromechanical complexes and systems

3 BASIC DISCIPLINES

Discipline Б6 "Electrical Materials" is studied in parallel with others Б1 "Higher Mathematics", Б2 "Physics") and contributes to the completeness of the achievement of the program learning outcome PLO07.

4 WORKLOAD DISTRIBUTION BY THE FORM OF EDUCATIONAL PROCESS ORGANIZATION AND TYPES OF CLASSES

Types of classes	Distribution by forms of education, <i>hours</i>							
	Full-time			Full-time		Extramural		
	Volume	Classes (C)	Individual work (IW)	Classes (C)	Individual work (IW)	Volume	Classes (C)	Individual work (IW)
lectures	45	16	29	-	-	45	4	41
practical	-	-	-	-	-	-	-	-
laboratory	45	16	29	-	-	45	4	41
seminars	-	-	-	-	-	-	-	-
Total	90	32	58	-	-	90	8	82

5 DISCIPLINE PROGRAM BY TYPES OF CLASSES

Code DLO	Types and topics of training sessions	Volume of components, <i>hours</i>
	LECTURES	45
PLO07.1-B6	1. Dielectric materials	20
	Polarization of dielectric materials in a constant electric field	
	Electrical conductivity of dielectrics	
	Electrical breakdown of dielectrics	
	Thermal properties of dielectrics	
	Some dielectric materials	
	Application of dielectric materials in electrotechnical devices	
	2. Conductive and magnetic materials	25
	Physical processes and phenomena in conductive materials	
	Metals of high electrical conductivity	
	Superconductors	
	Metals of high electrical resistance	
	Metals for various purposes	
	Non-metallic conductive materials and products	
	Physical processes and phenomena in magnetic materials	
	Some magnetic materials	
	LABORATORY CLASSES	45
PLO07.2-B6	Study of the properties of electrical insulating materials	45
	Determination of electrical strength of liquid dielectrics	
	Determination of volume and surface resistivities of solid dielectrics	
	Investigation of dielectric polarization	
	Study of the properties of magnetic materials	
	Investigation of the properties of magnetic materials using an oscilloscope	
	Determination of the specific magnetic resistance of ferromagnets	
	Investigation of magnetic properties of plate samples using a ferrometer	
TOTAL		90

For the implementation of the mixed form of education of students, the electronic resources of the e-learning platform in the discipline are used:

<https://do.nmu.org.ua/course/view.php?id=5793>

6 KNOWLEDGE PROGRESS TESTING

Certification of student achievement is accomplished through transparent procedures based on objective criteria in accordance with the University Regulations

“On Evaluation of Higher Education Applicants' Learning Outcomes”.

The level of competencies achieved in relation to the expectations, identified during the control activities, reflects the real result of the student's study of the discipline.

6.1 Grading scales

Assessment of academic achievement of students of the Dnipro University of Technology is carried out based on a rating (100-point) and institutional grading scales. The latter is necessary (in the official absence of a national scale) to convert (transfer) grades for mobile students.

The scales of assessment of learning outcomes of the DNIPROTECH students

Rating	Institutional
90 ... 100	відмінно / Excellent
74 ... 89	добре / Good
60 ... 73	задовільно / Satisfactory
0 ... 59	незадовільно / Fail

Discipline credits are scored if the student has a final grade of at least 60 points. A lower grade is considered to be an academic debt that is subject to liquidation in accordance with the Regulations on the Organization of the Educational Process of DNIPROTECH.

6.2 Tools and procedures

The content of diagnostic tools is aimed at controlling the level of knowledge, proficiency/skills, communication, autonomy, and responsibility of the student according to the requirements of the National Qualifications Framework (NQF) up to the 6th qualification level during the demonstration of the learning outcomes regulated by the work program.

During the control activities, the student should perform tasks focused solely on the demonstration of disciplinary learning outcomes (Section 2).

Diagnostic tools provided to students at the control activities in the form of tasks for the formative and summative knowledge progress testing are formed by specifying the initial data and a way of demonstrating disciplinary learning outcomes.

Diagnostic tools (control tasks) for the formative and summative knowledge progress testing are approved by the department.

Types of diagnostic tools and procedures for evaluating the formative and summative knowledge progress testing are given below.

Diagnostic and assessment procedures

FORMATIVE ASSESSMENT			SUMMATIVE ASSESSMENT	
training sessions	diagnostic tools	procedures	diagnostic tools	procedures
Lectures	Control task for each the topic	completing the assignment during the lecture	Complex Control Work (CCW)	Determination of average weighted result of formative assessments
Laboratory lessons	verification and protection	performance of laboratory work		CCW performance during the differentiated test at the request of the student

During the formative assessment, lecture classes are evaluated by determining the quality of performance of specific control tasks. Laboratory classes are evaluated by the quality of their performance and defense.

If the content of a certain type of classes is subordinated to several components of the description of the qualification level according to the NQF, the integral value of the grade can be determined taking into account the weighting coefficients set by the lecturer.

Provided that the level of results of the formative assessments of all types of training at least 60 points, the summative assessment can be carried out without the student's immediate participation by determining the weighted average value of the obtained grades.

Regardless of the results of the formative assessments, every student during the summative knowledge progress testing has the right to perform the CCW, which contains tasks covering key disciplinary learning outcomes.

The number of specific tasks of the CCW should be consistent with the allotted time for completion. The number of CCW options should ensure that the task is individualized.

The value of the mark for the implementation of the CCW is determined by the average evaluation of the components (specific tasks) and is final.

The integral value of the assessment of the implementation of the CCW can be determined taking into account the weighting coefficients established by the department for each component of the description of the qualification level of the NQF.

6.3 Criteria

Actual student learning outcomes are identified and measured relative to what is expected during the control activities using criteria that describe the student's actions to demonstrate the achievement of learning outcomes.

To assess the performance of control tasks during the formative assessment on lectures and laboratory classes the coefficient of mastery is used as a criterion, which automatically adapts the assessment indicator to the rating scale:

$$O_i = 100 a/m,$$

where a is a number of correct answers or significant operations performed in accordance with the solution standard; m is the total number of questions or significant operations of the standard.

Individual tasks and complex control works are assessed expertly using criteria that characterize the ratio of requirements to the level of competencies and indicators of assessment on a rating scale.

The content of the criteria is based on the competency characteristics defined by the NQF for the bachelor's level of higher education (given below).

***General criteria for achieving learning outcomes
for the 6th qualification level of NQF (bachelor)***

Description of qualification level	Requirements for knowledge, proficiency/skills, communication, autonomy and responsibility	Indicator evaluation
<i>Knowleges</i>		
Conceptual scientific and practical knowledge, critical understanding of theories, principles, methods and concepts in the field of professional activity and / or training	The answer is excellent - correct, reasonable, meaningful. Characterizes the presence of: - conceptual knowledge; - high degree of knowledge of the state of the art; - critical understanding of the basic theories, principles, methods and concepts in education and professional activity	95-100
	The answer contains minor errors or omissions	90-94
	The answer is correct, but has some inaccuracies	85-89
	The answer is correct, but has some inaccuracies and is insufficiently substantiated	80-84
	The answer is correct, but has some inaccuracies, insufficiently substantiated and meaningful	74-79
	The answer is fragmentary	70-73
	The answer shows the student's vague ideas about the object of study	65-69
	The level of knowledge is minimally satisfactory	60-64
	The level of knowledge is unsatisfactory	<60
<i>Proficiency/Skills</i>		
In-depth cognitive and practical skills, mastery and innovation at the level required to solve complex specialized tasks and practical problems in the field of professional activity or training	The answer characterizes the ability to: - identify problems; - formulate hypotheses; - solve problems; - choose appropriate methods and tools; - collect and interpret information logically and clearly; - use innovative approaches to solving problems	95-100
	The answer characterizes the ability to apply knowledge in practice with minor errors	90-94
	The answer characterizes the ability to apply knowledge in practice, but has some inaccuracies in the implementation of one requirement	85-89

Description of qualification level	Requirements for knowledge, proficiency/skills, communication, autonomy and responsibility	Indicator evaluation
	The answer characterizes the ability to apply knowledge in practice, but has some inaccuracies in the implementation of the two requirements	80-84
	The answer characterizes the ability to apply knowledge in practice, but has some inaccuracies in the implementation of the three requirements	74-79
	The answer characterizes the ability to apply knowledge in practice, but has some inaccuracies in the implementation of the four requirements	70-73
	The answer characterizes the ability to apply knowledge in practice when performing tasks on the model	65-69
	The answer characterizes the ability to apply knowledge in performing tasks on the model, but with inaccuracies	60-64
	The level of skills is unsatisfactory	<60
Communication		
<ul style="list-style-type: none"> ♦ reporting to specialists and non-specialists information, ideas, problems, solutions, own experience and argumentation ♦ data collection, interpretation and application ♦ communication on professional issues, including in a foreign language, orally and in writing 	<p>Fluency in industry issues. Clarity of the answer (report). Language:</p> <ul style="list-style-type: none"> - correct; - clean; - clear; - accurate; - logical; - expressive; - concise. <p>Communication strategy:</p> <ul style="list-style-type: none"> - consistent and consistent development of thought; - the presence of logical own judgments; - appropriate reasoning and its compliance with the defended provisions; - correct structure of the answer (report); - correct answers to questions; - appropriate technique for answering questions; - ability to draw conclusions and formulate proposals; 	95-100
	Sufficient knowledge of industry issues with minor flaws. Sufficient clarity of the answer (report) with minor flaws. Relevant communication strategy with minor flaws.	90-94
	Good knowledge of industry issues. Good clarity of the answer (report) and appropriate communication strategy (three requirements in total are not realized)	85-89
	Good knowledge of industry issues. Good clarity of the answer (report) and appropriate communication strategy (four requirements not implemented in total)	80-84
	Good knowledge of industry issues. Good clarity of the answer (report) and appropriate communication strategy (five requirements not implemented in total)	74-79
	Satisfactory knowledge of industry issues.	70-73

Description of qualification level	Requirements for knowledge, proficiency/skills, communication, autonomy and responsibility	Indicator evaluation
	Satisfactory clarity of the answer (report) and appropriate communication strategy (a total of seven requirements have not been implemented)	
	Partial knowledge of industry issues. Satisfactory clarity of the answer (report) and communication strategy with errors (a total of nine requirements are not implemented)	65-69
	Partial knowledge of industry issues. Satisfactory clarity of the answer (report) and communication strategy with errors (a total of 10 requirements are not implemented)	60-64
	The level of communication is unsatisfactory	<60
<i>Autonomy and responsibility</i>		
<ul style="list-style-type: none"> ♦ managing complex technical or professional activities or projects ♦ ability to take responsibility for making and making decisions in unpredictable work and / or learning contexts ♦ formation of judgments that take into account social, scientific and ethical aspects ♦ organization and management of professional development of individuals and groups ♦ ability to continue studies with a significant degree of autonomy 	<p>Excellent command of personal management competencies focused on:</p> <p>1) management of complex projects, which involves:</p> <ul style="list-style-type: none"> - research nature of educational activities, marked by the ability to independently assess various life situations, phenomena, facts, identify and defend a personal position; - ability to work in a team; - control of own actions; <p>2) responsibility for decision-making in unpredictable conditions, including:</p> <ul style="list-style-type: none"> - justification of own decisions by the provisions of the regulatory framework of the industry and state levels; - independence in the performance of tasks; - initiative in discussing problems; - responsibility for relationships; <p>3) responsibility for the professional development of individuals and/or groups of individuals, which involves</p> <ul style="list-style-type: none"> - use of professionally oriented skills; - use of evidence with independent and correct argumentation; - mastery of all types of learning activities; <p>4) the ability to continue learning with a high level of autonomy, which includes</p> <ul style="list-style-type: none"> - the degree of mastery of fundamental knowledge; - independence of evaluative judgments; - a high level of general learning skills; - - independent search and analysis of information sources 	95-100
	Good mastery of personality management competencies (two requirements not met)	90-94
	Good mastery of personality management competencies (three requirements not met)	85-89
	Good mastery of personality management competencies (four requirements not met)	80-84
	Good mastery of personality management competencies (six requirements not met)	74-79

Description of qualification level	Requirements for knowledge, proficiency/skills, communication, autonomy and responsibility	Indicator evaluation
	Satisfactory mastery of personality management competencies (seven requirements not met)	70-73
	Satisfactory mastery of personality management competencies (eight requirements not met)	65-69
	The level of responsibility and autonomy is fragmentary	60-64
	The level of autonomy and responsibility is unsatisfactory	<60

7 TOOLS, EQUIPMENT AND SOFTWARE

№ works (code)	Lab title	Tools, equipment and software used in the work
ETM-1.1	Study of the properties of electrical insulating materials	Box with prototypes of electrical materials
ETM-1.2	Determination of electrical strength of liquid dielectrics	Installation of АДІ-70 Dielectric gloves Dielectric boots Fuses
ETM-1.3	Determination of bulk and surface specific resistance of solid dielectrics	Samples of dielectric materials Theraometer
ETM-1.4	Investigation of dielectric polarization	Samples of dielectric materials AC bridge Electrodes
ETM-2.1	Study of the properties of magnetic materials	Box with prototypes of magnetic materials
ETM-2.2	Investigation of the properties of magnetic materials by using an oscilloscope	Sample of magnetic materials Integrator Oscillograph
ETM-2.3	Determination of the specific magnetic resistance of ferromagnets	Compensator Measuring instruments A sample of a ferromagnet Oscillograph
ETM-2.4	The study of magnetic properties of the plate samples by using ferrometra	Plate sample and Ferrometer easuring instruments

8 RECOMMENDED BIBLIOGRAPHY

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